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ABSTRACT

This booklet contains information on the Languages of the Disciplines Project, a federally funded program that seeks to identify the problems in receptive communication encountered by beginning university students in specific disciplines and the techniques for helping these students overcome their problems. The first section of the booklet notes the development of a communications gap across educational disciplines and fields of study, outlines the investigative model used in the project, and describes methods of collecting data for the project. The next section of the booklet provides details of student difficulties--particularly with vocabulary, metaphorical expressions, and special language styles--in selected disciplines, such as philosophy, physics, and psychology. The final section of the booklet lists instructional techniques and devices that teachers in all disciplines can use to prevent student problems in receptive communications. (RL)

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1981

LANGUAGES OF THE DISCIPLINES

Harry W. Sartain

A project based on a model for identifying and overcoming receptive communication problems that students encounter while studying in the university disciplines

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The Communications Gap . . . . page 2
The Investigative Model . . . page 5
Student Difficulties:
Some Findings . . . . . page 14
Preventing the Problems . . . page 18

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LANGUAGES OF THE DISCIPLINES

THE COMMUNICATION GAP

The growth in technology during the twentieth century has drastically changed the employment patterns of the nation's workers. While the majority of Americans at one time worked in agriculture, now only four per cent of them are able to fill our agricultural needs and provide vast quantities of food for export. Great numbers of farm workers eventually moved to the cities to take blue-collar jobs, but today only a few more than thirty per cent of Americans are employed in blue-collar labor. The majority of people now work in vocations and professions that require specialized skills and training. Consequently there is an ever-growing need for well-educated persons to operate the industries and services of the country.

At a time when the nation needs a smaller proportion of minimally educated persons and a larger number of health workers, engineers, social problem solvers, and creative thinkers, our colleges and universities are finding it difficult to con-

vince more students of the need for higher education. And they find it equally difficult to help and encourage some of the potentially capable individuals to remain in college after they have begun. One reason for this is the knowledge gap.

The often-mentioned explosion of knowledge apparently started a chain reaction that has provided a constant flow of information that is essential for successful study in the university disciplines. At the same time, however, it appears that the problems of social unrest and of limited financial support for the public schools have created a major gap between what some high school graduates have learned and what they need to know in order to succeed in beginning courses in colleges and universities. Therefore about one-fourth of the students who are admitted to higher education drop out in the first year and another fourth usually drop out or transfer before graduation.

There are many reasons why students have difficulty and become discouraged in their introductory college and university studies. One of the major reasons, according to faculty members who have taught college reading skills courses, is inadequately developed receptive communication skills. For quite a number of students there is a great gap between their levels of capability in obtaining information through reading and listening and the level of receptive communication skill that is required for success in courses. Faculty members from a number of fields of study have noted this type of communication gap.

Even persons who are highly educated in one field often find that they do not readily comprehend discussions among people who are specialized in another field. Each discipline seems to have not only its specialized vocabulary, but, also, its own style for organizing statements. This is most evident when any layman tries to follow the

jargon of an attorney. Therefore it is not at all surprising that many high school graduates may become very discouraged when trying to follow the ideas in professors' lectures and in college textbooks.

The project on The Languages of the Disciplines was conceived, therefore, to investigate and try to correct the receptive communication difficulties of students taking courses in various academic fields. Supported financially by the Fund for the Improvement of Postsecondary Education of the United States Department of Education and by the University of Pittsburgh, the project also has had strong backing from the Provost's Office and the University Research Center. Faculty members from the Psychology Department (CAS) and from Language Communications (Education) have been given time to coordinate the project, and others from Philosophy, Physics, and Psychology have given generously of their time and knowledge.

THE INVESTIGATIVE MODEL

The initiation of the project required the development and later revision of a set of procedural steps for identifying the receptive communication problems of students and for supporting professors in overcoming those difficulties. This sequence of steps can serve as a model for other schools wishing to investigate and correct the receptive communication problems of their own students.

As the model evolved, these were the major steps taken: (1) Establishing hypotheses, (2) Selecting experimental students and faculty, (3) Gathering data through student language study sessions, (4) Refining data and procedures through faculty involvement, (5) Seeking solutions to communications problems, (6) Testing and refining tentative solutions, and (7) Sharing the results. These steps will be explained in more detail.

Establishing Hypotheses

Two major hypotheses were developed; some portions being stated before the project was initiated and other portions being added as their importance became apparent. They are:

1. Receptive communication factors that interfere with the learning of some students in introductory university courses can be identified; among them the following may be found:

    a. Verbal explanations of key principles and abstract generalizations
    b. Technical vocabulary of the disciplines
    c. Advanced general vocabulary
    d. Metaphorical expressions specific to different disciplines
    e. Specialized styles of language used in different disciplines

f. Complex syntactic structures used in some textbooks and references
g. Language-related devices such as symbols, graphs, and tables

2. Special types of lessons and instructional devices can be located or devised and used by faculty members and their assistants in overcoming these problems.

These hypotheses were stated to guide the program development more than to serve as the bases for rigorous research. They have led, however, to the collection of a large amount of data.

Selecting Experimental Students and Faculty

Because of the impossibility of investigating problems in all of the disciplines at once, a decision was made to begin with three unrelated fields of study. The fall term class schedule was consulted to find courses that enrolled large numbers of students, and an introductory course in each of three broad areas was selected: a philosophy course in the humanities, a physics course in the physical sciences, and a psychology course in the social sciences. In the second year an English course was added to the program.

Thereafter the selection process proceeded as follows:

--Conferring with professors teaching sections of the courses to obtain cooperation from those who would be regular participants in the data collection and program development.

--Seeking volunteer participants from the class members at the first class session (Students were offered one extra credit in language study for the work.)

--Selecting for each course approximately fifteen participants from the volunteers by randomly choosing the needed number from those available at necessary times.

Gathering Data through
Language Study Sessions

Each of the language study leaders, who were advanced graduate student language specialists, was asked to attend the classes in one field regularly and to meet for an hour a week with the fifteen volunteer student participants from their classes. Each leader was assigned to audit the course in which he or she had the least background in order to get some idea of the problems a beginner might experience. Every week the undergraduate student volunteers were provided with log sheets on which to record (and classify) the specific words, phrases, sentences, symbols, and figures that gave them difficulty in the lectures or in the readings.

In brief, procedures for data collection were as follows:

--Language study leaders attended the content course classes regularly, taking notes, and observing student behavior.

--Students listed and classified their difficulties on the log sheets and later noted the correct meanings that they found for the points on which they were unclear.

--Student groups met for one hour weekly with the language study leaders to discuss their difficulties and attempt to improve their understandings of the subject content by sharing their interpretations and by responding to questions and comments of the leaders.

--Language study leaders collected the log sheets regularly and recorded on cards the different communication comprehension difficulties of the students.

--Language study leaders consulted the course textbooks and conferred with the course instructors and assistants to obtain greater understanding of the students' difficulties.

These procedures were followed for two trimesters during the first year with different professors teaching the courses each trimester. During the second trimester language study leaders were able to distinguish which "difficulties" were serious and which were only minor.

Refining Data and Procedures
through Faculty Involvement

Faculty members were involved in a variety of ways, some continuously and some occasionally.

--The cooperating professors conferred regularly with the language study group leaders, noting the difficulties recorded by the students and adding others that might be anticipated. They also made suggestions on how such difficulties could be overcome.

--A number of additional professors and teaching assistants from each of the three disciplines and related areas met individually or in groups with project personnel to react to the lists of difficulties noted by the study group leaders, to consider why students had such difficulties, and to offer ideas for preventing the difficulties in the future.

--An advisory committe of faculty members and administrators met from time to time with the project directors, the project coordinator,

and the group leaders to review plans and findings and to advise how to proceed in future activities.

Seeking Solutions

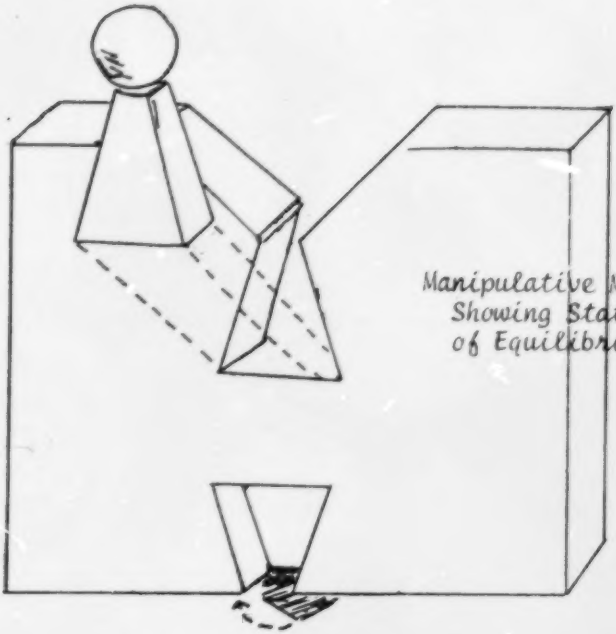
During the second trimester of the first year of the investigation the project staff began seeking instructional techniques and devices for overcoming the difficulties experienced by students. During the third trimester (summer) the whole task of the team was to identify such solutions and to prepare a manual of suggestions for future use by professors and teaching assistants. These efforts to seek solutions included the following steps:

--Faculty members who taught the courses and their colleagues, as mentioned previously, were a major source of ideas for techniques to overcome students' problems.

--Professional textbooks on teaching strategies, on college teaching, and on secondary and college reading were reviewed to provide a reservoir of ideas that could be referred to by the language study group leaders.

--Study group leaders began preparing devices, such as transparencies with overlays, comprehension structure charts, logical thinking guides, and concept demonstration gadgets, which were reviewed at meetings with the project directors and analyzed for their effectiveness in teaching. Some of the devices were also tested informally on the students in the language study sessions. This process led to an understanding of which procedures were and were not effective.

--Journals and reference books in each field of instruction were skimmed at the university library to find the best pedagogical ideas of writers in those areas.



Manipulative Model
Showing States
of Equilibrium

--The study group leaders then began a concentrated period of developing techniques and devices, using ideas gleaned from the references and from consulting with the project directors, the project coordinator, and a part-time consultant in college reading. A part-time artist was employed, also, to help prepare the illustrations needed for the instructional materials.

--The group succeeded in describing more than sixty techniques and devices for teaching specific terms, principles, metaphors, special language structures, and symbolic systems that had been particularly difficult for the students to understand in introductory courses. These were assembled into a manual for future reference use as desired by professors and assistants.

Testing and Refining
Suggested Solutions

During the second year the major activities of the project are to try out the instructional materials that have been devised, to revise them, and to extend them for future use. This involves:

--Trying out the special lessons and devices in the new language study sessions for each discipline (or in the "recitation" sections, which are small group supplements to the regular lecture classes).

--Revising the materials on the basis of their effectiveness.

--Adding new lesson techniques and devices.

--Providing a revised instructional aids manual for trial use by the course professors during the second trimester of the second year; and determining the effectiveness of the materials in the manual.

--Applying the whole process in a fourth area of study, English, at the University of Pittsburgh.

Sharing Results

The results, including both the information on types of difficulties that students have and the instructional materials for use in overcoming problems, are being shared within the University of Pittsburgh and outside the University as far as the information can be disseminated.

This process includes:

--Sharing the findings and the instructional aids manual with other professors in the disciplines involved at Pitt.

--Providing orientation workshops for college and high school faculties in Pennsylvania, Ohio, and West Virginia if they are interested in learning the results and the process involved.

--Presenting the findings and the process steps at professional meetings both regionally and nationally.

--Preparing professional journal articles to encourage faculties in other institutions to undertake this procedure to help more students succeed in introductory courses.

--Assisting other departments at Pitt to undertake similar investigations of how to make introductory courses more effective.

STUDENT DIFFICULTIES: SOME FINDINGS

During the fall trimester of the first year the students in the language study groups noted more than four hundred terms, explanations of principles, and other language factors that caused them difficulty in the three introductory courses in philosophy, physics, and psychology. During the second trimester the language study group leaders, working with different groups of students, assessed these "difficulties" carefully to differentiate between those that were real problems and those that were quite easily overcome through study and discussion.

In philosophy they found that the major problems included twenty-five technical terms, eight general vocabulary items, seven explanations of principles/generalizations, one metaphor, and one complex language structure. Additional bothersome difficulties that were not so serious included thirteen technical terms, ten general vocabulary items, three explanations of principles/generalizations, three metaphors, and two complex language structures.

In physics the serious difficulties included twenty-six technical terms and seven explanations of principles/generalizations. Other bothersome, but not serious problems included one hundred twenty-seven technical terms, thirty-seven items of general vocabulary, fourteen explanations of principles/generalizations, eight metaphors, three problems of specialized language style, three problems of complex sentence structures, and one difficulty with tabular material.

In psychology the serious difficulties included fifty-six technical terms, six explanations of principles/generalizations, ten metaphors, three problems of specialized language style, two highly complex language constructions, and two confusing

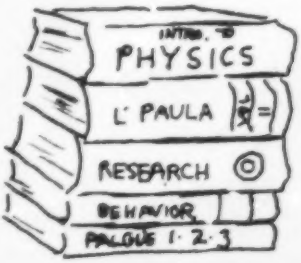
tabular presentations. Other bothersome items included another fifty technical terms, thirty-nine general vocabulary items,and fifty more explanations of principles.

Nobody was surprised that vocabulary was a major problem. A few examples of the many technical terms that caused difficulties for students are: "syllogism," "premiss," "adiabatic process," "angular momentum," "centripetal acceleration," "chunking," and "intervention." Some of the general vocabulary items that were unfamiliar to many students were: "eclectic," "pragmatic," "conjecture," "vacuous," and "contingent."

Metaphorical expressions might be considered to be simply another aspect of specialized vocabulary, so they often are difficult to distinguish. Some that caused problems for a number of students were "depositing charge," a planet "sweeps out" equal areas of its orbit, "rehearsal buffer," "decision tree," and another "tree" with "branches" that function in semantic tableaux. In connection

with both the metaphorical expressions and the technical vocabulary, students had problems understanding and remembering the specialized technical meanings of words that have other every-day meanings. Examples include: "work," "power," "mass," and "conservation."

Instructors noted that many students have a tendency simply to memorize explanations of principles and complex generalizations without fully understanding them. A few of the items for which they had difficulty comprehending the explanations were: the work-energy theorem, Bernoulli's Principle, Maxwell's distribution of speeds, and validity of an argument. Two specific examples of universal truths that were difficult to comprehend were: (1) "The validity of an argument is determined by the truth values of its premisses and its conclusion;" and (2) "A compound is truth-functional when its truth value can be determined under all possible circumstances by the truth values of the components."



Problems of special language style are difficult to separate from general explanations unless the observer readily recognizes unique language structures. This is not easy when one is reading in a field that is new to him or her. And the person who is highly trained in a field does not sense that certain language forms are strange to others. One example of specialized language style is the statement: "This difference was significant at the .01 level." This can be stated in plain English as: "The difference between these two averages could have occurred by chance only one time in a hundred."

Problems of specialized language style were encountered in philosophy in statements that begin with, "It is not the case that . . ." Likewise there was a problem in psychology with reading "removed in time and space" in such statements as "Language permits displacement, the transmission of information about objects or events that are removed in time or space (or both) from the communicator . . . "

The difficulties with language complexity were different from those of specialized language style. While "specialized style" refers to unique types of phraseology, "complexity" refers to unusually long or involved sentences that contain no unique forms of expression. Such sentences confuse students when they include more ideas than the student can relate and integrate from one intricate statement. Similarly, the language-related devices are not unusual; they simply are unfamiliar to many of the students.

PREVENTING THE PROBLEMS

The recommendations for preventing or overcoming the receptive communications difficulties of students in introductory university courses include both special lesson techniques and specific instructional devices. Often these can be used together, but they also can be used separately at times.

A number of types of lessons and devices are listed here, and a few are described briefly.

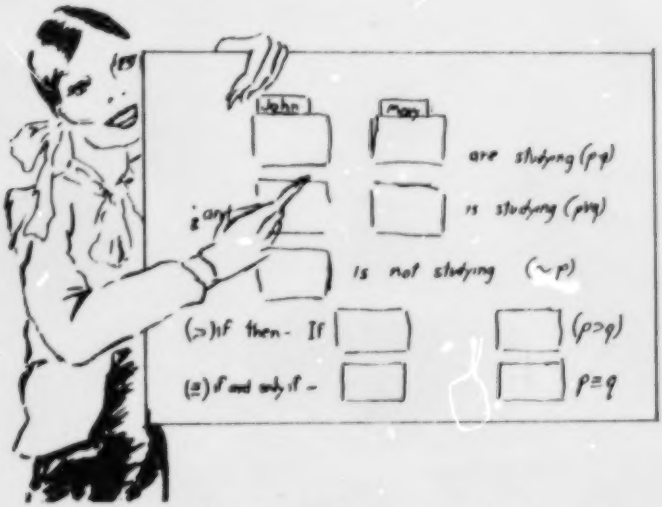
Lesson Techniques

The following lesson techniques were considered, and many were found to be suitable for the disciplines involved in this project. Some would be more useful in other disciplines.

- inductive concept formation procedure (Taba)
- inductive application of principles process (Taba)
- advance organizers (Ausubel)
- concept attainment procedure (Bruner)
- inquiry training
- synectics procedures
- contingency management
- field trips
- programmed lessons
- simulation experiences
- learning dyad or triad process
- demonstration lessons
- semantic mapping
- root webb procedure
- text reading guide
- guided inquiry
- project lesson
- syntax transformation process
- structured induction lesson
- directed reading activity
- SQ3R study system
- underscoring procedures

- self-recitation
- pretesting
- QUEST
- topic sentence perception
- summarizing
- memory model process
- Socratic questioning sequence
- reverse reasoning process for rule comprehension
- etymological analysis
- visual contrast approach to conceptualization
- role playing
- paired comparisons
- illustrated question sequence

Some of these lesson techniques were gleaned from references such as those by Joyce and Weil (1980), Singer and Donlan (1980), and Devine (1981). Others were originated by the team members or by the course instructors.



Procedures listed as lesson techniques are those that involve some sequence of interaction and thinking leading to a desired understanding without

any unusual instructional materials. In using the paired comparisons technique, for example, the instructor has the students compare terms, two at a time, to determine whether one term is subordinate, equivalent, or superordinate to the other; thereby the students sharpen their understandings of the concepts that are labelled by those terms.

As mentioned previously, cooperating teachers have said that one of the major difficulties many students have is a failure to conceptualize from their listening or reading. That is, they tend to memorize without truly understanding, and then they fail in trying to provide applications for rules and principles. This observation was made earlier also by Klopfer and Champagne (1979, 1980) after an investigation of students' difficulties in physics courses.

The reverse reasoning process for rule comprehension is an example of a lesson technique designed to overcome this problem. Here the instructor offers a rule that the students already have met previously, and gives them a step-by-step procedure to follow while trying to reason back to the roots of the rule. When students can do this successfully, the instructor can be quite sure that they really understand the rule instead of having merely memorized it.

Instructional Devices

Words are the coins of communication, but as with all currency, their value fluctuates. When students are constantly bombarded by words, they have difficulty sensing their full worth. Consequently language must be given extra life from time to time with visual aids that command attention and increase the clarity of the intended communication.

Many instructional devices have been used by teachers for centuries, but new ones are constantly needed for novelty and to help students cope with the increased complexity of the content of the university disciplines. The following are among those recommended in this situation. Again, some came from references and others were originated by the project team:

- continuum cards
- sorting box guides
- hierarchy charts

- marginal glosses
- transparencies
- transparencies with overlays
- semantic hierarchy diagrams
- general diagrams
- manipulative models
- drill games
- mock-ups
- charts and maps
- flash-cards
- graphs of several types
- formulas
- pictures
- simulation strips or boxes
- sequence folders
- wheel matchers
- dioramas
- critical attribute lists
- visual analogies devices
- visual contrast devices
- structured overview designs
- pie-chart models
- demonstrative cartoons
- population sample cards
- structured summary block designs
- contrast charts
- cartooned illustrations

The instructional devices tend to be specific objects or materials that are used, not as a whole lesson, but as a part of a lesson to build interest and understanding. The structured overview design, for example, is a diagram of cue-boxes and lines that provide the student with a bird's-eye view of a topic that is to be studied. The student fits the subtopics into the boxes to obtain an understanding of the relationships of the elements included in the total topic.

A second example is a set of inductive learning flash-cards. In one case, to explain incidental learning the students are told to obtain a certain

type of information as the cards are flashed; then they are asked to answer questions about other information that they could have learned incidentally from the same cards.

A set of population sample cards is a third example of an instructional device. Varying measures of a certain human characteristic, such as height, are noted on a large number of cards. Then samples of "people" can be drawn from the cards to illustrate normal distributions or, perhaps, significant differences between averages.

Obviously new times and new circumstances call for the development and utilization of new procedures for encouraging students to complete programs of higher education. The project on Languages of the Disciplines is an attempt to develop new techniques and to revitalize old ones in order to help a larger proportion of students succeed. Faculties wishing to adopt these processes or variations of them are invited to call upon members of the team for advice and/or to utilize the investigative model (page 5) to institute their own program development plans.

(H.W.S., 1981)

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Dr. Merle J. Moskowitz, Professor
Psychology

Mr. Rick Piccardi, Undergraduate Student
Psychology

Ms. Martha Pople, Graduate Student
Language Communications

Dr. Joel Reed, Director
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Dr. Susan Schiller, Director
Learning Skills Center

Dr. William L. Smith, Assoc. Professor
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Dr. Sarah G. Thomason, Assoc. Professor
Linguistics

Dr. Robert L. Wolke, Director
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Dr. Robert L. Wright, Lecturer
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